358
132

United States Department of Agriculture

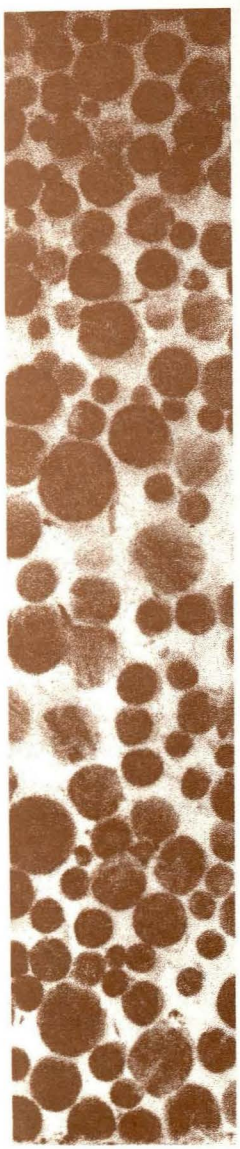
Forest Service

North Central Forest Experiment Station

Resource Bulletin **NC-132**

Residential Fuelwood Production and Sources From Roundwood in Missouri, 1987

Ronald L. Hackett, Daniel J. Witter, and W. Brad Smith



FOREWORD

This bulletin contains the results of a study of residential fuelwood production and sources in Missouri for the 1986-1987 heating season. Such detailed information is necessary for intelligent planning and decisionmaking in wood procurement, forest resource management, and forest industry development. Likewise, researchers need current fuelwood production information for planning projects. This report *does not* include harvesting for industrial fuelwood. Information related to commercial fuelwood is included in reports covering wood use by primary processing plants.

Special thanks are given to the Missouri households and commercial fuelwood producers who supplied information for this study. Their cooperation is greatly appreciated.

We especially thank Ms. Jan Syrigos and her team of telephone interviewers for their diligence in phoning and obtaining answers from these households and commercial fuelwood producers.

CONTENTS

Highlights 1
Historical Fuelwood Demand 2
Need for a Production Study 2
Analysis of Production 2
Summary and Conclusions 5
Study Methods 6
  Households 6
  Commercial Producers 7
Appendix 8
  Sampling Error 8
  Study Limitations 8
  Definition of Terms 9
  Common and Scientific Names of Tree Species Mentioned 9
  Tables Titles 10

North Central Forest Experiment Station
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication July 29, 1991
1991

Residential Fuelwood Production and Sources from Roundwood in Missouri, 1987

Ronald L. Hackett, Daniel J. Witter, and W. Brad Smith

HIGHLIGHTS

NOTE: *This report contains only information about fuelwood cut by households and commercial loggers for residential use. Fuelwood cut for industrial use and fuelwood originating from mill residues are not included. All volumes presented here are in standard cords—(128 cubic feet consisting of 79 cubic feet of wood and 49 cubic feet of bark and air space).*

- Total fuel production from roundwood in 1987 was 924 thousand cords.
- More than 99 percent of the fuelwood was cut by households; the remainder was cut by commercial producers.
- Oak comprised 60 percent of the fuelwood cut.
- Private land supplied 98 percent of the fuelwood cut.
- Rural woodlands furnished 53 percent of the fuelwood.
- The remaining 47 percent of fuelwood harvested came from other land classes: 8 percent came from cities and villages; 14 percent came from fencerows, windbreaks, and rural yards; and 25 percent came from pasture and cropland.
- Growing stock on timberland was a minor source of fuelwood. An estimated 99 thousand cords (11 percent) came from growing stock.
- Dead trees on timberland provided 35 percent of the fuelwood. Nongrowing stock on timberland provided twice the volume of fuelwood as growing stock.
- For equal amounts of fuelwood produced by commercial producers and households, commercial producers cut five times as much from growing stock on timberland as did households.

Ronald L. Hackett, Research Forester, received a B.S. in forest resources from the University of Minnesota. He joined the Forest Service in December 1974, and has been working with North Central's Forest Inventory and Analysis Unit since.

Daniel J. Witter has been a Social Research Analyst with the Missouri Department of Conservation since 1978. He received a B.A. from Millersville University, an M.S. from the Pennsylvania State University in 1974, and a Ph.D. from the University of Arizona in 1978. He conducts and analyzes social research in support of fish, forest, and wildlife management in Missouri.

W. Brad Smith, Principal Mensurationist, received a B.S. degree in forestry in 1975 and an M.S. degree in forest management in 1977 from Purdue University. He joined the Forest Service in May 1977, and has been working with North Central's Forest Inventory and Analysis Unit since October 1977.

HISTORICAL FUELWOOD DEMAND

Until the late 1800's wood was the primary source of energy in the United States, but by 1900 it provided only about 25 percent of this country's energy. Between 1949 and 1974, fuelwood use declined steadily for utilities, residences, and commercial businesses, although industrial fuelwood use increased steadily during that period. Wood supplied only 2 percent or 0.40 quads (0.40 quadrillion BTU's) of U.S. energy in 1972, the year before the Arab embargo sent oil prices spiraling upward. Between 1974 and 1981, spurred by higher prices for fossil fuels such as coal, oil, and natural gas, Americans increased their overall use of wood fuels by 45 percent, according to the U.S. Department of Energy (DOE). In 1986, wood furnished about 0.78 quads of energy, approximately 1.5 percent of the Nation's total energy consumption. Researchers at the Forest Products Laboratory of the USDA Forest Service estimate that American households burned 39 million cords of fuelwood during the 1985-1986 heating season, an amount equal to 15 percent of the Nation's total timber harvest[1]. Demand for residential fuelwood is expected to exceed 50 million cords annually by the year 2010.

NEED FOR A PRODUCTION STUDY

A study of Missouri fuelwood production from roundwood in 1987 was required to provide estimates of fuelwood production for the fourth Missouri forest inventory and to determine the impact of fuelwood production on the forest resource. Forest managers and users are asking the following kinds of questions about the magnitude of the fuelwood harvest and the sources of the wood: How much fuelwood is harvested from forest land (timberland)? Urban areas? Fencerows and windbreaks? Pastures and cropland? How much fuelwood comes from public land? Does most of the fuelwood come from growing stock? Are dead trees an important source of fuelwood? Are commercial fuelwood producers a major source? What are the principal species cut? Where are the principal fuelwood-producing areas in Missouri? Are saw log markets threatened by fuelwood producers?

To answer these and related questions in Missouri, a cooperative study was completed in 1987 by the North Central Forest Experiment Station and the Missouri Department of Conservation (MDC).

ANALYSIS OF PRODUCTION

Geographic source—The Prairie Unit supplied 33 percent of the 924 thousand cords of fuelwood harvested from roundwood in 1987. Twenty-eight percent was supplied by the Riverborder Unit, and 15 percent was supplied by the Southwest Ozark Unit. The Eastern Ozark and Northwest Ozark Units each supplied 12 percent of the fuelwood harvested (fig. 1).

Type of producer—Fuelwood producers are divided into two segments—households and commercial producers. Households cut nearly all (99.8 percent) of the 1987 fuelwood production. Harvesting by commercial producers provided only 0.2 percent of the fuelwood production and took place mainly in the Riverborder Unit:

Unit	Production		
	Households	Loggers	Total
	(Thousand cords)		
Eastern Ozarks	114	*	114
Southwest Ozarks	135	*	135
Northwest Ozarks	110	*	110
Prairie	306	*	306
Riverborder	257	2	259
Total	922	2	924

* Less than 500 cords

[1] *High, Colin; Skog, Kenneth E. 1989. Current and projected wood energy consumption in the United States. In: Proceedings of the IGT Conference on Energy from Biomass and Wastes 13. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory (Draft).*

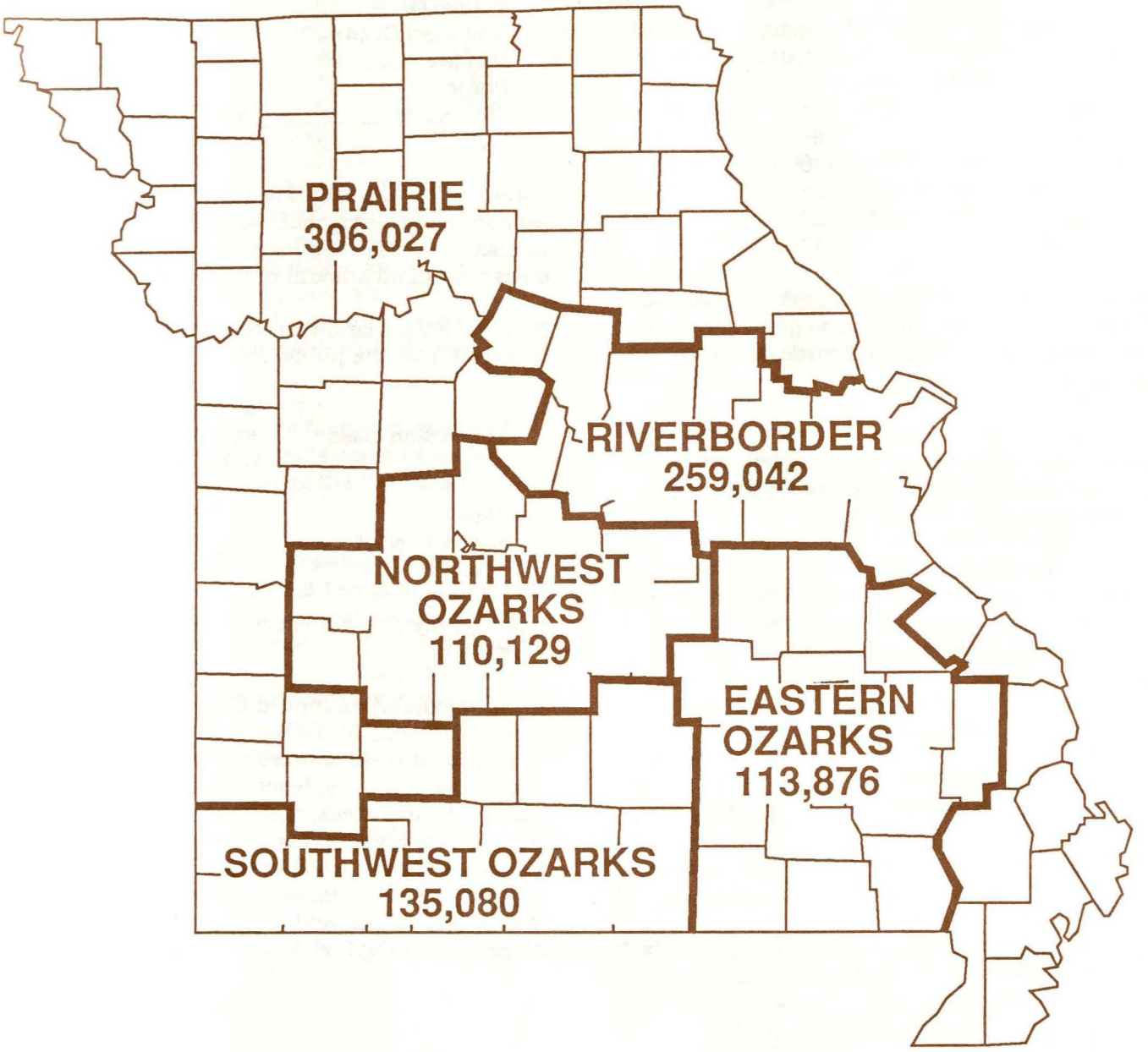


Figure 1.—*Missouri fuelwood production from roundwood by Forest Survey Unit, 1987, in standard cords.*

Species—Oak was the principal fuelwood species, accounting for 60 percent of the total harvested. Leading species cut were:

Species	Volume (Thousand cords)	Percent
Oak	551	60
Hickory	85	9
Elm	45	5
Ash	31	3
Maple	20	2
Locust	17	2

No other individual species supplied more than 15 thousand cords. Softwoods (pine and redcedar) supplied 7 thousand cords (less than 1 percent).

Oak was the predominant fuelwood species in every Unit; elm replaced hickory between surveys as the second most predominant species in the Prairie Unit (see table 7).

Private vs. public land—Private land provided 98 percent of the fuelwood cut. The Mark Twain National Forest provided nearly two-thirds of the fuelwood from public land in the Eastern and Southwest Ozark Units (fig. 2).

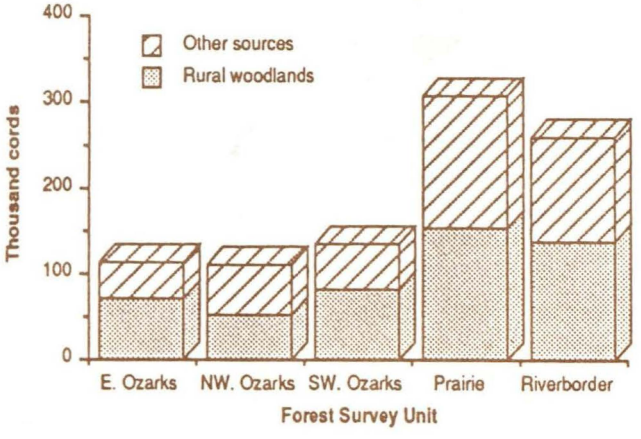


Figure 2.—*Residential fuelwood production from roundwood by Forest Survey Unit and major source of material.*

Unit	Private (Thousand cords)	Public
Eastern Ozarks	107.2	6.7
Southwest Ozarks	130.0	5.0
Northwest Ozarks	107.7	2.4
Prairie	303.6	2.4
Riverborder	256.9	2.1
All	905.4	18.6

Forest industry land (owned by firms with primary wood-using mills) supplied only 2 thousand cords of fuelwood. Forest industry owns a nominal amount of land in Missouri.

National Forest land was the chief source of fuelwood from the public sector:

Public land class	Fuelwood volume (Thousand cords)	Percent
State	7.3	37
National Forest	12.2	63
Total	19.5	100

Oak was the primary species cut on National Forest land.

Rural woodlands[2] supplied 53 percent of residential fuelwood in the State. The remainder came from diverse sources such as cities and villages; windbreaks, fencerows, and yards of homes in rural areas; and pasture and cropland. Rural woodland supplied more than 70 percent of the fuelwood in the more heavily forested Eastern Ozarks, Southwest Ozarks, Northwest Ozarks, and Riverborder Units and 30 percent of the fuelwood in the Prairie Unit.

[2] *"Rural woodlands" as used in the survey questionnaire was the area outside city and village limits, fencerows, windbreaks, yards of homes, pasture, and cropland from where fuelwood was harvested. It was assumed to be timberland.*

Unit	Rural woodlands	Other land
	(Thousand cords)	
Prairie	152	154
Riverborder	136	123
Southwest Ozarks	80	55
Eastern Ozarks	72	42
Northwest Ozarks	54	56
All	494	430

Of the 47 percent of fuelwood harvested from other sources (nontimberland and nonforest land areas), 8 percent came from cities and villages; 14 percent came from fencerows, windbreaks, and rural yards; and 25 percent came from pasture and cropland. Oak and hickory were the principal fuelwood species cut on these lands.

Eighty-five percent of the fuelwood produced inside city and village limits came from the heavily urbanized areas of the Prairie and Riverborder Units.

Growing stock vs. nongrowing stock—Growing stock (see Definition of Terms in Appendix) on timberland was not a major source of fuelwood. Of the 924 thousand cords of fuelwood cut from roundwood, an estimated 99 thousand cords (11 percent) came from growing stock on timberland. Producers cut another 395 thousand cords (43 percent) from nongrowing stock on timberland:

Source	Volume of fuelwood	Percent
	(Thousand cords)	
Growing stock on timberland	99	11
Tops and limbs of growing stock trees on timberland	36	4
Cull trees and cull sections of growing stock on timberland	33	3
Dead trees on timberland	326	35
Saplings	([3])	([4])
All trees on nonforest and nontimberland	430	47
Total	924	100

[3] *Less than 500 cords.*

[4] *Less than 0.5 percent.*

Nonforest sources (such as cities, villages, pasture, cropland, fencerows, and windbreaks) supplied 430 thousand cords (47 percent).

None of the Forest Survey Units had large quantities of growing stock harvested from timberland for fuelwood. The highest proportion cut from growing stock was in the Eastern Ozark Unit:

Unit	Fuelwood cut from growing stock	Percent of Unit total
	(Thousand cords)	
Eastern Ozarks	18	16
Southwest Ozarks	17	13
Prairie	31	10
Northwest Ozarks	10	9
Riverborder	23	9
State total	99	11

Harvesting of dead trees on timberland for fuel was proportionally higher in the Prairie and Riverborder Units because of the expansion of major urban areas (St. Louis and Kansas City) in these Units. Oak and hickory were the primary species of dead trees harvested.

Unit	Fuelwood from dead trees on timberland	Percent
	(Thousand cords)	
Prairie	98	30
Riverborder	98	30
Southwest Ozarks	51	16
Eastern Ozarks	42	13
Northwest Ozarks	37	11
State total	326	100

For reporting purposes, the volumes of several miscellaneous species were combined into aggregate groups of "other softwoods," "other hardwoods," and "noncommercial" species. These data were considered too weak to report at the county level. Table 3 shows the distribution of these species as reported by households on a Survey Unit basis.

SUMMARY AND CONCLUSIONS

Total output of fuelwood during 1987 in Missouri from roundwood was 924 thousand cords. This volume of fuelwood contained sufficient heat value to replace approximately 9.2 million

gallons of No. 2 fuel oil [5]. More than 99 percent of the 924 thousand cords harvested was hardwoods.

The Prairie Unit contains 44 percent of all Missouri land and about 16 percent of the forest land, but it produced 33 percent of the fuelwood. The denser population in the large urban areas of the Prairie Unit compared to the rest of the State was a major reason for the greater intensity of fuelwood harvesting in the Unit.

Households outproduced commercial cutters by a ratio of 402 to 1 statewide. Private nonforest and nontimberland were the chief sources of fuelwood. Slightly more than half of the production was on rural woodlands, but nearly twice the number of cords cut on rural woodlands came from dead trees.

Growing stock on timberland was a minor source of fuelwood, accounting for only 11 percent of the production. Nongrowing stock on timberland yielded twice the volume of fuelwood as growing stock did. Dead trees on timberland accounted for 35 percent of fuelwood produced.

Commercial producers cut a nominal amount of fuelwood in 1987. However, they cut a much greater proportion from growing stock on timberland (five times more) than households cut. If commercial producers become more important suppliers of fuelwood, the percentage of growing stock in the mix of fuelwood can be expected to rise.

Some forest managers and wood procurement managers in Missouri may fear that large quantities of fuelwood are being cut from growing stock that previously would have been used for saw logs and other forest products. Our study results should relieve many of their concerns. Much of the fuelwood is from dead trees unlikely to be suitable for other products and from trees on nonforest and nontimberland that are not generally a forest industry supply source.

During the next 5 to 10 years, growing stock is likely to remain a minor source of Missouri fuelwood. Large quantities of dead trees, tops and limbs, and trees on nonforest land are available each year for fuelwood use. Followup fuelwood studies at 5-year intervals would be useful in determining trends in harvesting growing stock for fuel. Changes in the commercial producer to household fuelwood production ratio will be significant in determining the proportion of fuelwood cut from growing stock on timberland.

Use of dead trees and cull trees, with careful selection on timberland for fuel, provides a certain level of timber stand improvement for increased productivity. As demand for fuelwood has increased, more of these trees have been removed for a profit as fuel. Consequently, less money has been required for a given level of timber stand improvement than if fuelwood demand had remained at low levels.

STUDY METHODS

Data for this publication came from sampling Missouri households and canvassing commercial fuelwood producers with formal questionnaires approved by the Federal Office of Management and Budget.

Households

The respondent universe was all households in Missouri with listed telephones. Missouri was divided into eight districts: (1) the St. Louis Metro District consists of St. Charles and St. Louis Counties and the city of St. Louis, and contains 615,284 households, (2) the Kansas City Metro District contains 325,010 households, (3) the Springfield Metro District contains 76,470 households, and (4) the five non-metro districts contain 917,956 households.

A total sample size of 3,995 households was selected based on funding available and a desired standard error of less than ± 20 percent statewide at one standard deviation. To insure at least 4 households would be sampled in each county, 3,651 sample households were selected in the non-metro districts. The sample size ranged from 4 households in Worth County to 207 in Jackson County.

[5] *In comparing heat value between fuels, another factor to consider is the energy required to produce and deliver the fuels to the consumer.*

Households were selected for the sample by the Missouri Department of Conservation using systematic random sampling techniques. In each of the districts, households were selected from current phone books using the following procedures:

1. Collect all current phone directories within the county.

2. Eliminate all duplicate books and numbers; eliminate all out-of-county numbers.

3. Estimate the total number of residential numbers in each book. Eliminate all non-household numbers (business, institutional, etc.) in each book. Record the number of pages per book.

4. Determine the number of calls to be made from each book and the interval per call by the following equations:
   a. Total residential numbers in all books divided by sample size equals interval per call.
   b. Number of residential phones per book divided by interval per call equals number of calls needed from this book.
   c. Number of pages per book divided by number of calls per book equals interval per call for this book.

5. The *nth* name in the *nth* column, depending on the interval per call, was selected for the call. A Missouri Department of Conservation contractor interviewed the sample households by phone using a formal questionnaire prepared by the North Central Forest Experiment Station. The survey was conducted from July through September 1988. Calls were made each week night from 5:30 to 9:00 p.m.

Initial editing was completed by Missouri Department of Conservation personnel, and the North Central Station did the final editing and compiled the data. Some respondents did not know the species cut for fuel, except in general terms such as mixed hardwoods. To facilitate reporting for each county, we prorated mixed hardwoods proportionally to each of the hardwood species specifically identified as being harvested in that county.

Sampling rates were about four times higher in the non-metro districts. Expansion factors were determined for households by dividing the number of households in a district by the number of sample households in that district. These expansion factors were used to estimate the total fuelwood production by households in each county.

Commercial Producers

A list of commercial fuelwood producers was compiled for the State by the Missouri Department of Conservation. Sources of the compilation were the yellow pages of Missouri telephone directories and Missouri newspaper ads for fuelwood available for sale. Newspaper ads were scanned for several months, and 119 commercial producers were found.

Using a formal questionnaire similar to that used for households, MDC personnel canvassed a random sample of commercial producers by phone during April 1988. Possible duplicate sampling of commercial producers was minimized by questioning all sample households producing more than 20 cords of fuelwood to determine if they were commercial producers.

Logging utilization factors for fuelwood were used in estimating the quantity of growing stock cut for fuelwood on timberland. The Station developed these factors in Michigan during 1964-1965 by measuring trees cut for fuelwood on active harvesting operations. Sixty-seven percent of the fuelwood cut from live trees on timberland was estimated to be from the growing-stock portion of the tree. An estimated 27 percent of the fuelwood cut or collected from logging residue (waste) on timberland was also from the growing-stock portion of the trees.

APPENDIX

SAMPLING ERROR

All the reported figures are estimates based on sampling procedures that are designed to give accurate estimates of fuelwood production. A measure of reliability of these figures is given by sampling errors. This sampling error means that the chances are two out of three that the results for the sample differ by no more than the amount indicated from the results that would have been obtained if a complete census of all households and commercial producers had been made. The total sampling error for fuelwood production was ± 6.6 percent on a volume of 924 thousand cords.

Sampling errors by sample unit were as follows:

Sample Unit	Volume (Thousand cords)	Error (Percent)
Eastern Ozarks	114	14.7
Southwest Ozarks	135	10.1
Northwest Ozarks	110	11.3
Prairie [6]	306	14.1
Riverborder[7]	259	13.2
All Units	924	6.6

STUDY LIMITATIONS

Two components of total fuelwood production are not included in this report. First, fuelwood produced from wood residue generated at primary wood-using mills (such as sawmills, cooperage mills, etc.) is not included. However, a cooperative Missouri primary wood-using mill study between the Missouri DOC and the North Central Forest Experiment Station will provide an estimate of fuelwood produced from primary mill residue. Information on this source of fuelwood will be published in another paper.

Second, fuelwood produced from wood residue generated at secondary wood-using mills (such as millwork plants, furniture plants, and office and store equipment manufacturers) was not estimated. Secondary wood-using mill residue is a minor source of fuelwood that has no direct impact and only a nominal indirect influence on the forest resource used for fuel.

Households without listed telephones were not sampled. Study results may be slightly biased if the fuelwood harvest per household without listed phones is significantly different in quantity or sources from the fuelwood harvest per household with listed phones. Harvesting characteristics by these two groups was assumed to be similar, and expansion factors for estimating total fuelwood production took into account all households in Missouri.

Respondents were asked how much fuelwood they cut during the previous 12 months. Commercial producers were asked a similar question about their firms. Because the study was conducted during several months in 1987, the actual fuelwood harvest was for varying 12-month periods in 1986 and 1987, depending on when the respondent was called. For respondents who did not know how much a cord was, it was explained by dimension or size of vehicle used to transport the fuelwood. In this paper, production has been dated as 1987 for ease of discussion. We assume that the exact date does not significantly affect the analysis or findings.

Commercial producers who do not advertise in the yellow pages or in newspapers were not included in the study. However, because the producers included in the study cut small quantities of fuelwood we believe the quantity excluded is insignificant.

[6] *This includes the Kansas City Metro and Springfield Metro Districts.*

[7] *This includes the St. Louis Metro District.*

DEFINITION OF TERMS

Commercial producers.—Commercial fuelwood operators. Those who harvest fuelwood to sell to dealers or consumers. Includes loggers who harvest fuelwood along with saw logs and other products.

Forest industry land.—Land owned by companies or individuals operating primary wood-using mills.

Fuelwood production.—Fuelwood harvest. The fuelwood portion of roundwood production. The fuelwood volume of roundwood products.

Growing-stock.—Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

Logging residue.—The unused portions of trees cut or killed by logging.

Logging waste.—See Logging residue.

National Forest land.—Federal land that has been legally designated as National Forest or purchase units, and other land under the administration of the USDA Forest Service.

Nonforest land.—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, power line clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area to qualify as nonforest land.)

Nontimberland.—See Nonforest land.

Primary wood-using mills.—Mills receiving roundwood or chips from roundwood for processing into products.

Primary wood-using mill residue.—Wood materials (coarse and fine) and bark generated at manufacturing plants from roundwood processed into principal products. These residues include wood products (byproducts) obtained incidental to production of principal products and wood materials not utilized for some product.

Roundwood.—Logs and bolts from harvested trees including chips from harvested trees.

Standard cord.—A pile of logs 4x4x8 feet (128 cubic feet including air space and bark). A cord of fuelwood contains 79 cubic feet of wood and 49 cubic feet of bark and air space.

State land.—Land owned by States or land leased to them for 50 years or more.

Timberland.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. Areas qualifying as timberland have the capability of producing in excess of 20 cubic feet per acre per year of annual growth under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future. In this paper, "woodland areas outside city or village limits (rural woodland)" were assumed to be timberland.

Woodland.—See Timberland.

COMMON AND SCIENTIFIC NAMES OF TREE SPECIES MENTIONED

SOFTWOODS

Shortleaf pine ..... *Pinus echinata*
Virginia pine ..... *Pinus virginiana*
Baldcypress ..... *Taxodium distichum*
Eastern redcedar ..... *Juniperus virginiana*

Other softwoods
Scotch pine ..... *Pinus sylvestris*

HARDWOODS

Select white oak
White oak ..... *Quercus alba*
Swamp white oak ..... *Quercus bicolor*
Bur oak ..... *Quercus macrocarpa*
Swamp chestnut oak ..... *Quercus michauxii*
Chinkapin oak ..... *Quercus muehlenbergii*
Other white oak
Overcup oak ..... *Quercus lyrata*
Chestnut oak ..... *Quercus prinus*
Post oak ..... *Quercus stellata*
Select red oak
Cherrybark oak ..... *Quercus falcata* var. *pagodifolia*
Northern red oak ..... *Quercus rubra*
Shumard oak ..... *Quercus shumardii* var. *shumardii*
Other red oak
Scarlet oak ..... *Quercus coccinea*
Northern pin oak ..... *Quercus ellipsoidalis*
Southern red oak ..... *Quercus falcata*
Shingle oak ..... *Quercus imbricaria*
Black oak ..... *Quercus velutina*
Blackjack oak ..... *Quercus marilandica*
Pin oak ..... *Quercus palustris*
Willow oak ..... *Quercus phellos*
Select hickory
Pecan ..... *Carya illinoensis*
Shellbark hickory ..... *Carya lacinosa*
Shagbark hickory ..... *Carya ovata*
Mockernut hickory ..... *Carya tomentosa*
Other hickory
Bitternut hickory ..... *Carya cordiformis*
Pignut hickory ..... *Carya glabra*
Black hickory ..... *Carya texana*
River birch ..... *Betula nigra*
Hard maple
Sugar maple ..... *Acer saccharum*
Soft maple
Red maple ..... *Acer rubrum*
Silver maple ..... *Acer saccharinum*
Ash
Blue ash ..... *Fraxinus quadrangulata*
White ash ..... *Fraxinus americana*
Green ash ..... *Fraxinus pennsylvanica*
Cottonwood ..... *Populus deltoides*
Basswood ..... *Tilia americana*
Beech ..... *Fagus grandifolia*
Black walnut ..... *Juglans nigra*
Black cherry ..... *Prunus serotina*
Butternut ..... *Juglans cinerea*
Elm
Winged elm ..... *Ulmus alata*
American elm ..... *Ulmus americana*
Slippery elm ..... *Ulmus rubra*
Rock elm ..... *Ulmus thomasii*
Hackberry ..... *Celtis occidentalis*
Sycamore ..... *Platanus occidentalis*
Yellow-poplar ..... *Liriodendron tulipifera*
Black willow ..... *Salix nigra*
Sweetgum ..... *Liquidambar styraciflua*
Tupelo
Black tupelo ..... *Nyssa sylvatica* var. *sylvatica*
Swamp tupelo ..... *Nyssa sylvatica* var. *biflora*
Persimmon ..... *Diospyros virginiana*
Sassafras ..... *Sassafras albidum*
Other hardwoods
Ohio buckeye ..... *Aesculus glabra*
Boxelder ..... *Acer negundo*
Kentucky coffeetree ..... *Gymnocladus dioicus*
Black locust ..... *Robinia pseudoacacia*
White mulberry ..... *Morus alba*
Red mulberry ..... *Morus rubra*
Honeylocust ..... *Gleditsia triacanthos*
Northern catalpa ..... *Catalpa speciosa*
Noncommercial species
Osage-orange ..... *Maclura pomifera*
Eastern hophornbeam ..... *Ostrya virginiana*
Apple ..... *Malus* spp.
American hornbeam ..... *Carpinus caroliniana*
Wild plum ..... *Prunus* spp.
Eastern redbud ..... *Cercis canadensis*
Pawpaw ..... *Asimina triloba*
Hawthorn ..... *Crataegus* spp.

TABLE TITLES

Table 1.—Fuelwood production from roundwood by species group and source of material, Missouri, 1987

Table 2.—Fuelwood production from roundwood by species group and owner class, Missouri, 1987

Table 3.—Fuelwood production distribution for "other softwoods," "other hardwoods," and "noncommercial" species groups by individual species and Forest Survey Unit, Missouri, 1987

Table 4.—Fuelwood production from roundwood by Forest Survey Unit and source of material, Missouri, 1987

Table 5.—Fuelwood production from roundwood by Forest Survey Unit and owner class, Missouri, 1987

Table 6.—Distributed fuelwood production from roundwood by Forest Survey Unit and source of material, Missouri, 1987

Table 7.—Fuelwood production from roundwood by Forest Survey Unit and species group, Missouri, 1987

Table 1.—Fuelwood production from roundwood by species group and source of material, Missouri, 1987

Species group	All sources	Cities and villages	Windbreaks, fencerows, and rural yards	Pasture and cropland	Rural woodlands: Standing live trees	Rural woodlands: Logging waste	Rural woodlands: Dead trees	Other sources
			(In standard cords)					
E. redcedar	3,990	--	1,396	917	1,038	--	639	--
Pine	2,952	737	597	395	604	--	619	--
Other softwoods	522	--	176	--	--	--	346	--
Total softwoods	7,464	737	2,169	1,312	1,642	--	1,604	--
Oak	551,403	28,624	73,788	128,469	95,951	16,616	207,955	--
Hickory	85,162	3,879	9,960	22,353	13,347	1,697	33,926	--
Maple	19,560	2,258	1,877	8,454	2,237	--	4,734	--
Elm	44,782	9,024	3,229	12,317	7,944	10	12,258	--
Ash	30,932	4,216	3,645	8,973	5,261	551	8,286	--
Locust	16,708	328	1,957	5,640	2,916	85	5,782	--
Other hardwoods	125,408	16,882	10,217	34,108	15,988	1,170	46,195	848
Noncommercial	42,735	2,616	23,786	8,418	2,585	361	4,969	--
Total hardwoods	916,690	67,827	128,459	228,732	146,229	20,490	324,105	848
All species	924,154	68,564	130,628	230,044	147,871	20,490	325,709	848

Table 2.—Fuelwood production from roundwood by species group and owner class, Missouri, 1987

Species group	All ownership	National forest	State	Forest industry	Other private
		(In standard cords)			
E. redcedar	3,990	--	420	--	3,570
Pine	2,952	--	--	--	2,952
Other softwoods	522	--	--	--	522
Total softwoods	7,464	--	420	--	7,044
Oak	551,403	9,600	5,621	2,314	533,868
Hickory	85,162	712	--	--	84,450
Maple	19,560	--	--	--	19,560
Elm	44,782	--	--	--	44,782
Ash	30,932	--	--	--	30,932
Locust	16,708	--	--	--	16,708
Other hardwoods	125,408	980	1,287	--	123,141
Noncommercial	42,735	--	--	--	42,735
Total hardwoods	916,690	11,292	6,908	2,314	896,176

Table 3.—Fuelwood production distribution for "other softwoods," "other hardwoods," and "noncommercial" species groups by individual species and Forest Survey Unit, Missouri, 1987

(In standard cords)

Species group	All units	Forest Survey Unit				
		Eastern Ozarks	Southwest Ozarks	Northwest Ozarks	Prairie	Riverborder
OTHER SOFTWOODS						
Cypress	169	169	--	--	--	--
Spruce	353	--	--	--	353	--
Total	522	169	--	--	353	--
OTHER HARDWOODS						
Birch	1,034	--	--	--	707	327
Blackgum	84	--	--	--	--	84
Black cherry	1,496	--	196	--	1,160	140
Boxelder	1,406	--	--	--	127	1,279
Cottonwood	4,006	1,691	--	60	1,705	550
Dogwood	128	--	--	28	100	--
Hackberry	2,663	--	--	212	2,381	70
Mulberry	4,964	--	--	--	170	4,794
Persimmon	301	--	224	--	--	77
Sassafras	672	--	224	--	--	448
Sweetgum	224	--	--	--	--	224
Sycamore	2,949	1,578	469	226	410	266
Black walnut	8,640	536	691	2,591	4,374	448
Willow	140	--	--	140	--	--
Yellow-poplar	56	--	--	--	--	56
Unspecified hardwoods	96,645	2,718	15,198	10,197	32,934	35,598
Total	125,408	6,523	17,002	13,454	44,068	44,361
NONCOMMERCIAL						
Apple	3,134	--	--	--	3,134	--
Osage-orange	38,775	225	224	2,092	33,621	2,613
Hawthorn	226	--	--	--	226	--
Russian olive	600	--	--	--	600	--
Total	42,735	225	224	2,092	37,581	2,613

Table 4.—Fuelwood production from roundwood by Forest Survey Unit and source of material, Missouri, 1987

Forest Survey Unit	All sources	Cities and villages	Windbreaks, fencerows, and rural yards	Pasture and cropland	Rural woodlands			Other sources
					Standing live trees	Logging waste	Dead trees	
			(In standard cords)					
Eastern Ozarks	113,876	4,757	17,307	19,705	26,323	4,251	41,533	--
Southwest Ozarks	135,080	2,940	15,206	36,780	24,596	4,380	51,178	--
Northwest Ozarks	110,129	1,191	10,334	44,776	16,011	426	37,391	--
Prairie	306,027	28,513	64,121	60,176	45,251	9,609	97,509	848
Riverborder	259,042	31,163	23,660	68,607	35,690	1,824	98,098	--
State Total	924,154	68,564	130,628	230,044	147,871	20,490	325,709	848

Table 5.—Fuelwood production from roundwood by Forest Survey Unit and owner class, Missouri, 1987

Forest Survey Unit	Owner class				
	All ownerships	National forest	State	Forest Industry	Other private
			(In standard cords)		
Eastern Ozarks	113,876	6,672	0	981	106,223
Southwest Ozarks	135,080	2,659	2,390	--	130,031
Northwest Ozarks	110,129	1,121	1,261	1,121	106,626
Prairie	306,027	--	2,390	212	303,425
Riverborder	259,042	840	1,287	--	256,915
State Total	924,154	11,292	7,328	2,314	903,220

Table 6.—Distributed fuelwood production from roundwood by Forest Survey Unit and source of material, Missouri, 1987

Forest Survey Unit	Total all sources	Timberland						Non-timberland
		Total from timberland	Growing stock		Saplings	Cull trees	Dead trees	
			Boles	Tops and limbs				
		(In standard cords)						
Eastern Ozarks	113,876	72,107	17,731	6,672	71	6,100	41,533	41,769
Southwest Ozarks	135,080	80,154	16,678	6,389	68	5,842	51,178	54,926
Northwest Ozarks	110,129	53,828	10,202	3,239	34	2,962	37,391	56,301
Prairie	306,027	152,369	31,103	12,342	131	11,285	97,509	153,658
Riverborder	259,042	135,612	22,977	7,552	80	6,905	98,098	123,430
State Total	924,154	494,070	98,691	36,194	384	33,094	325,709	430,084

Table 7.—Fuelwood production from roundwood by Forest Survey Unit and species group, Missouri, 1987

Species group	State total	Forest Survey Unit				
		Eastern Ozarks	Southwest Ozarks	Northwest Ozarks	Prairie	Riverborder
		(In standard cords)				
E. redcedar	3,990	0	385	779	214	2,612
Pine	2,952	141	560	1,421	177	653
Other softwoods	522	169	0	0	353	0
Total softwoods	7,464	310	945	2,200	744	3,265
Oak	551,403	79,617	98,791	82,871	146,456	143,668
Hickory	85,162	20,080	12,781	7,720	19,937	24,644
Maple	19,560	2,432	2,128	1,011	4,811	9,178
Elm	44,782	2,488	2,453	290	29,580	9,971
Ash	30,932	1,495	532	491	10,986	17,428
Locust	16,708	706	224	0	11,864	3,914
Other hardwoods	125,408	6,523	17,002	13,454	44,068	44,361
Noncommercial	42,735	225	224	2,092	37,581	2,613
Total hardwoods	916,690	113,566	134,135	107,929	305,283	255,777
All species	924,154	113,876	135,080	110,129	306,027	259,042

☆ U.S. GOVERNMENT PRINTING OFFICE: 1991-557-271/40242

Hackett, Ronald L.; Witter, Daniel J.; Smith, W. Brad.
1991. **Residential fuelwood production and sources from roundwood in Missouri, 1987.** Resour. Bull. NC-132. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 15 p.

Discusses and analyzes 1987 Missouri fuelwood production from roundwood. Analyzes production by geographic areas, type of producer, species, landowner class, type of land, and tree source.

KEY WORDS: Growing stock, households, commercial producer, private land.

Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.

NORTH CENTRAL
FOREST
EXPERIMENT STATION